Listing of Claims

This listing of claims replaces all prior versions, and listings, of claims in the application:

1. (Currently Amended) A photoresist comprising:

a polymer backbone;

a lactone bonded to the polymer backbone and having a tertiary carbon bonded to the lactone carbonyl oxygen, the lactone being reactable under semiconductor processing conditions and in the presence of an acid to undergo a ring-opening reaction and form an open ring structure to switch a solubility of the photoresist in a developer without generating an organic species that can outgas in a vacuum environment;

a first group comprising nitrogen dioxide and attached to the carbon bonded to the lactone carbonyl oxygen; and

a side chain bonded to the polymer backbone, the side chain comprising a styrene ring.

2. (Original) The photoresist of Claim 1, wherein the lactone comprises a five-sided ring of carbon and oxygen.

3. (Original) The photoresist of Claim 1, wherein the lactone comprises a six-sided ring of carbon and oxygen.

4. (Canceled)

5. (Currently Amended) The photoresist of Claim [[4]] 1, wherein the first group comprises an electron-withdrawing group.

6. (Currently Amended) The photoresist of Claim [[4]] 14, wherein the ~~first~~ second group comprises an alkyl group.

7. (Currently Amended) The photoresist of Claim [[4]] 14, wherein the ~~first~~ second group comprises a cage group.

8. (Currently Amended) The photoresist of Claim [[4]] 14, wherein the ~~first~~ second group comprises a phenyl group.

9. (Currently Amended) The photoresist of Claim [[4]] 14, wherein the ~~first~~ second group comprises carbon, oxygen and hydrogen.

10. (Canceled)

11. (Currently Amended) The photoresist of Claim [[4]] 14, wherein the ~~first~~ second group comprises hydroxide.

12. (Currently Amended) The photoresist of Claim [[4]] 14, wherein the ~~first~~ second group comprises $-CF_3$.

13. (Currently Amended) The photoresist of Claim [[4]] 1, further comprising a second group attached to the carbon bonded to the lactone carbonyl oxygen, the first and second groups comprising the same molecules.

14. (Currently Amended) The photoresist of Claim [[4]] 1, further comprising a second group attached to the carbon bonded to the lactone carbonyl oxygen, the first and second groups comprising different molecules.

15. (Previously Presented) The photoresist of Claim 1, further comprising a photoacid generator molecule to form the acid upon radiation exposure.

16. (Previously Presented) The photoresist of Claim 1, wherein the lactone is reactable in the presence of the acid to change a solubility of the photoresist in a basic aqueous developer.

17. (Previously Presented) The photoresist of Claim 1, wherein the lactone is reactable in the presence of the acid to form an open ring structure bound to the polymer backbone with no outgassing molecules in a vacuum environment.

18. (Original) The photoresist of Claim 17, wherein the open ring structure increases solubility of the photoresist in an aqueous base developer.

19. (Original) The photoresist of Claim 1, further comprising a side chain styrene group bonded to the polymer backbone.

20. (Original) The photoresist of Claim 19, wherein the side chain styrene group is attached to a group comprising at least one of hydroxide (OH), an alkyl group and a cage group.

21. (Currently Amended) A method comprising:

forming a photoresist having a polymer backbone, a lactone bonded to the polymer backbone, and a side group bonded to the polymer backbone, wherein the side group includes a styrene ring; and

switching the solubility of the photoresist in a developer by exposing the lactone under vacuum, wherein the switching of the solubility causes the lactone to undergo a ring opening reaction upon exposure to an acid catalyst without molecules outgassing from the photoresist, and

wherein the lactone includes

a tertiary carbon bonded to the lactone carbonyl oxygen, and

a first group comprising $-CF_3$ and attached to the tertiary carbon bonded to the lactone carbonyl oxygen.

22. (Original) The method of Claim 21, wherein forming the photoresist comprises forming a chemically amplified photoresist.

23. (Currently Amended) The method of Claim 21, wherein forming the photoresist comprises forming the photoresist with a ~~first~~ second group attached to the carbon bonded to the lactone carbonyl oxygen, the ~~first~~ second group comprising one or more of an alkyl group, a cage group, and a phenyl group.

24. (Currently Amended) The method of Claim 21, wherein forming the photoresist comprises forming the photoresist with ~~first and~~ a second ~~groups~~ group attached to the carbon bonded to the lactone carbonyl oxygen, the first and second groups being identical.

25. (Currently Amended) A method comprising:

radiating an area of a chemically amplified photoresist in a vacuum environment to generate an acid within the photoresist and catalyze a ring-opening reaction of a lactone that includes a tertiary carbon bonded to the lactone carbonyl oxygen, wherein the chemically amplified photoresist includes

a side group bonded to the polymer backbone and the side group includes a styrene ring, and

a first group comprising nitrogen dioxide and attached to the carbon bonded to the lactone carbonyl oxygen; and

catalyzing a ring-opening reaction in the photoresist, the ring-opening reaction sufficing to switch the solubility of the photoresist in a developer without the generation of molecules that outgas from the photoresist in the vacuum environment.

26. (Previously Presented) The method of Claim 25, wherein said radiating comprises radiating with extreme ultraviolet (EUV) radiation.

27. (Previously Presented) The method of Claim 25, wherein said radiating comprises radiating the area of the photoresist comprising a hydroxystyrene copolymer.

Claims 28.-30. (Canceled)

31. (Previously Presented) The method of claim 21, wherein forming the photoresist comprises forming the polymer backbone using a hydroxystyrene copolymer.

32. (Previously Presented) The method of claim 21, wherein forming the photoresist comprises forming the lactone to undergo the ring opening reaction upon exposure to the acid catalyst and under semiconductor processing conditions.

33. (Currently Amended) A photoresist comprising:

a polymer backbone;

a lactone fused to the polymer backbone, the lactone comprising a tertiary carbon bonded to the lactone carbonyl oxygen;

a first group comprising $-CF_3$ and attached to the carbon bonded to the lactone carbonyl oxygen; and

a styrene ring side chain bonded to the polymer backbone,

wherein sufficient lactone is fused to the polymer backbone so that a ring-opening reaction of the lactone to form an open ring structure suffices to switch a solubility of the photoresist in a developer.

34. (Previously Presented) A photoresist comprising:

a lactone bonded to a polymer backbone, the lactone being reactable under semiconductor processing conditions and in the presence of an acid to undergo a ring-opening reaction and form an open ring structure without generating an organic species that can outgas in a vacuum environment, the lactone having a first group comprising nitrogen dioxide attached to the carbon bonded to the lactone carbonyl oxygen.

35. (Previously Presented) A photoresist comprising:

a lactone bonded to a polymer backbone, the lactone being reactable under semiconductor processing conditions and in the presence of an acid to undergo a ring-opening reaction and form an open ring structure without generating an organic species that can outgas in a vacuum environment, the lactone having a first group comprising $-CF_3$ attached to the carbon bonded to the lactone carbonyl oxygen.